42. The system of claim **41**, wherein the at least one portion of the channel containing the stopped fluid is in communication with the heating system varying the temperature in the at least one portion of the channel to perform the amplification and the denaturation analysis.

43. The system of claim **41**, wherein the temperature of the fluid is continuously increased at a rate in the range of 0.1° C./second to 1° C./second.

44. The system of claim **41**, wherein the temperature of the fluid is continuously increased at a rate in the range of 0.01° C./second to 0.1° C./second.

45. The system of claim **41**, wherein the temperature of the fluid is continuously increased at a rate in the range of 1° C./second to 10° C./second.

46. The system of claim **37**, wherein the fluid continuously flows through the at least one portion of the channel and the amplification and the denaturation analysis are performed in the continuously flowing fluid.

47. The system of claim **46**, wherein the at least one portion of the channel containing the continuously flowing fluid is in communication with the heating system varying the temperature in the at least one portion of the channel to perform the amplification and the denaturation analysis including measuring the detectable property as a function of a continuously increasing temperature.

48. The system of claim **37**, wherein the cycling of the temperature of the at least one portion of the microfluidic channel comprises varying an electric current used to joule heat the at least one portion.

49. The system of claim **37**, wherein the cycling of the temperature of the at least one portion of the microfluidic channel comprises varying the temperature of the at least one portion using a non-joule heating system.

50. The system of claim **49**, wherein the non-joule heating system comprises placing the at least one portion of the microfluidic channel in thermal contact with a thermal block, wherein the temperature is cycled by varying the temperature of the thermal block.

51. The system of claim **49**, wherein the non-joule heating system comprises passing an electric current through resistive heating elements in thermal contact with the at least one portion of the microfluidic channel, wherein the temperature is cycled by varying the current passing through the resistive heating elements.

52. The system of claim **51**, wherein the resistive heating elements are fabricated onto a surface of the microfluidic device.

53. The system of claim **37**, wherein the amplification is performed by using a technique selected from a group consisting of: PCR and LCR.

54. The system of claim **37**, wherein the amplification reagents include primers, a thermostable polymerase, and nucleotides.

55. The system of claim **37**, wherein the detectable property comprises fluorescence.

56. The system of claim **55**, wherein the fluorescence is generated by FRET or a molecular beacon.

57. The system of claim **55**, wherein the fluorescence is generated by a fluorescent dye, and wherein the amount of fluorescence generated by the fluorescent dye is indicative of the extent of thermal denaturation of the nucleic acid.

58. The system of claim **57**, wherein the fluorescent dye is selected from the group consisting of: an intercalating dye, ethidium bromide, a minor groove binding dye, and a SYBR green dye.

59. The system of claim **37**, wherein the detectable property is selected form the group consisting of: fluorescence polarization, UV absorbance.

60. The system of claim **37**, wherein the detectable property is selected from the group of heat capacity, electrical resistance, and dielectric properties.

61. The system of claim **37**, wherein the system further comprises:

a fluid comprising a molecule of a known melt temperature (T_m), the fluid flowing through the channel, wherein a physical parameter that correlates with the temperature within the channel is being varied,

a detector configured to measure a value of a detectable property of the molecule as a function of the parameter, wherein a thermal property curve for the molecule is generated; and

a processor configured to determine the values of the detectable property and the parameter at the point in the thermal property curve that corresponds to the T_m of the molecule and derive the fluid temperature in the channel of microfluidic device based upon the determined values of the detectable property and the parameter.

62. The system of claim **61**, wherein the molecule of known T_m is selected from the group consisting of: a nucleic acid with a known sequence, biotin, biotin-4-fluorescein, fluorescein biotin, avidin, streptavidin, and neutravidin.

63. The system of claim **61**, wherein the physical parameter is selected from the group consisting of: the temperature of a thermal block in thermal contact with the channel, the current applied to the fluid in order to joule heat the fluid, and the current applied to a resistive heating element in thermal contact with the channel.

64. A method of determining the thermal inertia of a microfluidic device, the method comprising:

flowing a fluid comprising a fluorescent material through a channel in a microfluidic device, wherein the amount of fluorescence generated by the fluorescent material varies with temperature,

varying the temperature of an external surface of the microfluidic device, wherein the variation comprises a pattern with a recognizable feature, wherein the variation in temperature of the external surface produces a corresponding variation in temperature within the channel, and wherein the variation in temperature in the channel produces a corresponding variation in the amount of fluorescence generated by the fluorescent material,

measuring the fluorescence generated by the fluorescent material in the channel, and

determining a time offset between the temperature variations of the external surface and the variations in the amount of fluorescent by measuring the time delay between the imposition of the recognizable feature on the external surface and the appearance of the recognizable feature in the fluorescence generated by the fluorescent material, whereby the time offset is indicative of the thermal inertia.

65. The method of claim **64**, wherein the pattern is a sine wave.